AMENDMENTS TO THE CLAIMS

The listing of the claims will replace all prior versions, and listings, of claims:

LISTING OF CLAIMS:

Claims 1-38 (canceled)

Claim 39 (original): A method of multivariate spectral analysis, comprising the steps of:

a) obtaining an estimate of spectral error covariance $\mathbf{E_A}$ for measured set of multivariate spectral data $\mathbf{A}$;

b) decomposing the spectral error covariance $\mathbf{E_A}$ according to $\mathbf{E_A} = \mathbf{TP} + \mathbf{E}$, where $\mathbf{T}$ is a set of n x r scores and $\mathbf{P}$ is a set of r x p loading vectors obtained from factor analysis of the spectral error covariance $\mathbf{E_A}$, and $\mathbf{E}$ is a set of n x p random errors and spectral variations not useful for prediction;

c) guessing pure-component spectra $\mathbf{K}$ for the set of multivariate spectral data $\mathbf{A}$;

d) predicting a set of component values $\hat{\mathbf{C}}$ according to

$\hat{\mathbf{C}} = \mathbf{AK}^{\mathrm{T}}(\mathbf{KK}^{\mathrm{T}})^{-1} = \mathbf{A}(\mathbf{K}^{\mathrm{T}})^{+}$;

e) augmenting the set of predicted component values $\hat{\mathbf{C}}$ with at least one vector of the $\mathbf{T}$ scores to obtain a first set of augmented component values $\hat{\tilde{\mathbf{C}}}$;

f) estimating augmented pure-component spectra $\hat{\tilde{\mathbf{K}}}$ according to

$\hat{\tilde{\mathbf{K}}} = (\hat{\tilde{\mathbf{C}}}^{\mathrm{T}}\hat{\tilde{\mathbf{C}}})^{-1}\hat{\tilde{\mathbf{C}}}^{\mathrm{T}}\mathbf{A} = \hat{\tilde{\mathbf{C}}}^{+}\mathbf{A}$;

g) testing for convergence according to $\left\|\mathbf{A} - \hat{\tilde{\mathbf{C}}}\hat{\tilde{\mathbf{K}}}\right\|^{2}$;

h) predicting a second set of augmented component values $\hat{\tilde{\mathbf{C}}}$ according to

$\hat{\tilde{\mathbf{C}}} = \mathbf{A}\hat{\tilde{\mathbf{K}}}^{\mathrm{T}}(\hat{\tilde{\mathbf{K}}}\hat{\tilde{\mathbf{K}}}^{\mathrm{T}})^{-1} = \mathbf{A}(\hat{\tilde{\mathbf{K}}}^{\mathrm{T}})^{+}$;

i) replacing the augmented portion of the second set of augmented component values $\hat{\tilde{\mathbf{C}}}$ with the at least one vector of the $\mathbf{T}$ scores to obtain a third set of augmented component values $\hat{\tilde{\mathbf{C}}}$; and

j) repeating steps f) through i) at least once.

Claim 40 (original): The method of Claim 39, wherein the steps f) through i) are repeated until the test of step g) converges to obtain an alternating classical least squares solution for $\hat{\tilde{\mathbf{K}}}$ and $\hat{\tilde{\mathbf{C}}}$.

Claim 41 (original): The method of Claim 39, further comprising replacing the augmented portion of the augmented pure-component spectra $\hat{\tilde{\mathbf{K}}}$ with at least one vector of the **P** loading vectors prior to step h).

Claim 42 (original): The method of Claim 39, further comprising augmenting $\hat{\tilde{\mathbf{K}}}$ with at least one vector representing a spectral shape that is representative of at least one additional source of spectral variation prior to step h).

Claim 43 (original): The method of Claim 39, further comprising applying at least one constraint to the non-augmented portion of $\hat{\tilde{\mathbf{K}}}$ at step f).

Claim 44 (original): The method of Claim 43, wherein the at least one constraint is selected from the group consisting of non-negativity, equality, closure, monotonic constraint, unimodality, and selectivity.

Claim 45 (original): The method of Claim 39, further comprising applying at least one constraint to the non-augmented portion of $\hat{\tilde{\mathbf{C}}}$ at step h).

Claim 46 (original): The method of Claim 45, wherein the at least one constraint is selected from the group consisting of non-negativity, equality, closure, monotonic constraint, unimodality, and selectivity.

Claim 47 (original): The method of Claim 39, wherein the guessed pure-component spectra **K** comprises random numbers.

Claim 48 (original): The method of Claim 39, wherein the measured set of multivariate spectral data **A** comprises image data.

Claim 49 (original): The method of Claim 48, wherein the spectral error covariance $\mathbf{E_A}$ is obtained from a shift difference generated from a single image.

Claim 50 (original): The method of Claim 48, wherein the spectral error covariance $\mathbf{E_A}$ is obtained from repeat image spectra.

Claim 51 (original): A method of multivariate spectral analysis, comprising the steps of:

a) obtaining an estimate of spectral error covariance $\mathbf{E_A}$ for measured set of multivariate spectral data $\mathbf{A}$;

b) decomposing the spectral error covariance $\mathbf{E_A}$ according to $\mathbf{E_A} = \mathbf{TP} + \mathbf{E}$, where $\mathbf{T}$ is a set of n x r scores and $\mathbf{P}$ is a set of r x p loading vectors obtained from factor analysis of the spectral error covariance $\mathbf{E_A}$, and $\mathbf{E}$ is a set of n x p random errors and spectral variations not useful for prediction;

c) guessing pure-component spectra $\mathbf{K}$ for the set of multivariate spectral data $\mathbf{A}$;

d) augmenting the pure-component spectra $\mathbf{K}$ with at least one vector of the $\mathbf{P}$ loading vectors to obtain first augmented pure-component spectra $\tilde{\mathbf{K}}$;

e) predicting a first set of augmented component values $\hat{\tilde{\mathbf{C}}}$ according to $\hat{\tilde{\mathbf{C}}} = \mathbf{A}\tilde{\mathbf{K}}^{\mathrm{T}}(\tilde{\mathbf{K}}\tilde{\mathbf{K}}^{\mathrm{T}})^{-1} = \mathbf{A}(\tilde{\mathbf{K}}^{\mathrm{T}})^{+}$;

f) estimating second augmented pure-component spectra $\hat{\tilde{\mathbf{K}}}$ according to $\hat{\tilde{\mathbf{K}}} = (\hat{\tilde{\mathbf{C}}}^{\mathrm{T}}\hat{\tilde{\mathbf{C}}})^{-1}\hat{\tilde{\mathbf{C}}}^{\mathrm{T}}\mathbf{A} = \hat{\tilde{\mathbf{C}}}^{+}\mathbf{A}$;

g) testing for convergence according to $\left\|\mathbf{A} - \hat{\tilde{\mathbf{C}}}\hat{\tilde{\mathbf{K}}}\right\|^{2}$;

h) replacing the augmented portion of the second augmented pure-component spectra $\hat{\tilde{\mathbf{K}}}$ with the at least one vector of the $\mathbf{P}$ loading vectors to obtain third augmented pure-component spectra $\hat{\tilde{\mathbf{K}}}$; and

i) predicting a second set of augmented component values $\hat{\tilde{\mathbf{C}}}$ according to $\hat{\tilde{\mathbf{C}}} = \mathbf{A}\hat{\tilde{\mathbf{K}}}^{\mathrm{T}}(\hat{\tilde{\mathbf{K}}}\hat{\tilde{\mathbf{K}}}^{\mathrm{T}})^{-1} = \mathbf{A}(\hat{\tilde{\mathbf{K}}}^{\mathrm{T}})^{+}$;

j) repeating steps f) through i) at least once.

Claim 52 (original): The method of Claim 51, wherein the steps f) through i) are repeated until the test of step g) converges to obtain an alternating classical least squares solution for $\hat{\hat{\mathbf{K}}}$ and $\hat{\hat{\mathbf{C}}}$.

Claim 53 (original): The method of Claim 51, further comprising replacing the augmented portion of the set of augmented component values $\hat{\hat{\mathbf{C}}}$ with at least one vector of the **T** scores prior to step h).

Claim 54 (original): The method of Claim 51, further comprising augmenting $\hat{\hat{\mathbf{K}}}$ with at least one vector representing a spectral shape that is representative of at least one additional source of spectral variation prior to step h).

Claim 55 (original): The method of Claim 51, further comprising applying at least one constraint to the non-augmented portion of $\hat{\hat{\mathbf{K}}}$ at step f).

Claim 56 (original): The method of Claim 55, wherein the at least one constraint is selected from the group consisting of non-negativity, equality, closure, monotonic constraint, unimodality, and selectivity.

Claim 57 (original): The method of Claim 51, further comprising applying at least one constraint to the non-augmented portion of $\hat{\hat{\mathbf{C}}}$ at step h).

Claim 58 (original): The method of Claim 57, wherein the at least one constraint is selected from the group consisting of non-negativity, equality, closure, monotonic constraint, unimodality, and selectivity.

Claim 59 (original): The method of Claim 51, wherein the guessed pure-component spectra **K** comprises random numbers.

Claim 60 (original): The method of Claim 51, wherein the measured set of multivariate spectral data **A** comprises image data.

Claim 61 (original): The method of Claim 60, wherein the estimate of the error covariance $\mathbf{E_A}$ is obtained from a shift difference generated from a single image.

Claim 62 (original): The method of Claim 60, wherein the estimate of the error covariance $\mathbf{E_A}$ is obtained from repeat image spectra.

Claim 63 (original): A method of multivariate spectral analysis, comprising the steps of:

a) obtaining an estimate of the spectral error covariance $\mathbf{E_A}$ for measured set of multivariate spectral data $\mathbf{A}$;

b) decomposing the spectral error covariance $\mathbf{E_A}$ according to $\mathbf{E_A} = \mathbf{TP} + \mathbf{E}$, where $\mathbf{T}$ is a set of n x r scores and $\mathbf{P}$ is a set of r x p loading vectors obtained from factor analysis of the spectral error covariance $\mathbf{E_A}$, and $\mathbf{E}$ is a set of n x p random errors and spectral variations not useful for prediction;

c) guessing a set of component values $\mathbf{C}$ for the set of multivariate spectral data $\mathbf{A}$;

d) estimating pure-component spectra $\hat{\mathbf{K}}$ according to $\hat{\mathbf{K}} = (\mathbf{C}^T\mathbf{C})^{-1}\mathbf{C}^T\mathbf{A} = \mathbf{C}^+\mathbf{A}$;

e) augmenting the pure-component spectra $\hat{\mathbf{K}}$ with at least one vector of the $\mathbf{P}$ loading vectors to obtain first augmented pure-component spectra $\hat{\tilde{\mathbf{K}}}$;

f) predicting a first set of augmented component values $\hat{\tilde{\mathbf{C}}}$ according to $\hat{\tilde{\mathbf{C}}} = \mathbf{A}\hat{\tilde{\mathbf{K}}}^T(\hat{\tilde{\mathbf{K}}}\hat{\tilde{\mathbf{K}}}^T)^{-1} = \mathbf{A}(\hat{\tilde{\mathbf{K}}}^T)^+$;

g) testing for convergence according to $\left\|\mathbf{A} - \hat{\tilde{\mathbf{C}}}\hat{\tilde{\mathbf{K}}}\right\|^2$;

h) estimating second augmented pure-component spectra $\hat{\tilde{\mathbf{K}}}$ according to $\hat{\tilde{\mathbf{K}}} = (\hat{\tilde{\mathbf{C}}}^T\hat{\tilde{\mathbf{C}}})^{-1}\hat{\tilde{\mathbf{C}}}^T\mathbf{A} = \hat{\tilde{\mathbf{C}}}^+\mathbf{A}$;

i) replacing the augmented portion of the second augmented pure-component spectra $\hat{\tilde{\mathbf{K}}}$ with the at least one vector of the $\mathbf{P}$ loading vectors to obtain a third augmented pure-component spectra $\hat{\tilde{\mathbf{K}}}$ and

j) repeating steps f) through i) at least once.

Claim 64 (original): The method of Claim 63, wherein the steps f) through i) are repeated until the test of step g) converges to obtain an alternating classical least squares solution for $\hat{\tilde{\mathbf{K}}}$ and $\hat{\tilde{\mathbf{C}}}$.

Claim 65 (original): The method of Claim 63, further comprising replacing the augmented portion of the set of augmented component values $\hat{\hat{\mathbf{C}}}$ with at least one vector of the **T** scores prior to step h).

Claim 66 (original): The method of Claim 63, further comprising augmenting $\hat{\hat{\mathbf{K}}}$ with at least one vector representing a spectral shape that is representative of at least one additional source of spectral variation prior to step h).

Claim 67 (original): The method of Claim 63, further comprising applying at least one constraint to the non-augmented portion of $\hat{\hat{\mathbf{K}}}$ at step h).

Claim 68 (original): The method of Claim 67, wherein the at least one constraint is selected from the group consisting of non-negativity, equality, closure, monotonic constraint, unimodality, and selectivity.

Claim 69 (original): The method of Claim 63, further comprising applying at least one constraint to the non-augmented portion of $\hat{\hat{\mathbf{C}}}$ at step f).

Claim 70 (original): The method of Claim 69, wherein the at least one constraint is selected from the group consisting of non-negativity, equality, closure, monotonic constraint, unimodality, and selectivity.

Claim 71 (original): The method of Claim 63, wherein the guessed set of component values **C** comprises random numbers.

Claim 72 (original): The method of Claim 52, wherein the measured set of multivariate spectral data **A** comprises image data.

Claim 73 (original): The method of Claim 62, wherein the spectral error covariance $\mathbf{E_A}$ is obtained from a shift difference generated from a single image.

Claim 74 (original): The method of Claim 62, wherein the spectral error covariance $\mathbf{E_A}$ is obtained from repeat image spectra.

Claim 75 (original): A method of multivariate spectral analysis, comprising the steps of:

a) obtaining an estimate of the spectral error covariance $\mathbf{E_A}$ for measured set of multivariate spectral data $\mathbf{A}$;

b) decomposing the spectral error covariance $\mathbf{E_A}$ according to $\mathbf{E_A} = \mathbf{TP} + \mathbf{E}$, where $\mathbf{T}$ is a set of n x r scores and $\mathbf{P}$ is a set of r x p loading vectors obtained from factor analysis of the spectral error covariance $\mathbf{E_A}$, and $\mathbf{E}$ is a set of n x p random errors and spectral variations not useful for prediction;

c) guessing a set of component values $\mathbf{C}$ for the set of multivariate spectral data $\mathbf{A}$;

d) augmenting the set of component values $\mathbf{C}$ with at least one vector of the $\mathbf{T}$ scores to obtain a first set of augmented component values $\tilde{\mathbf{C}}$;

e) estimating augmented pure-component spectra $\hat{\tilde{\mathbf{K}}}$ according to

$$\hat{\tilde{\mathbf{K}}} = (\tilde{\mathbf{C}}^{\mathrm{T}}\tilde{\mathbf{C}})^{-1}\tilde{\mathbf{C}}^{\mathrm{T}}\mathbf{A} = \tilde{\mathbf{C}}^{+}\mathbf{A};$$

f) testing for convergence according to $\left\| \mathbf{A} - \tilde{\mathbf{C}}\hat{\tilde{\mathbf{K}}} \right\|^2$;

g) predicting a second set of augmented component values $\hat{\tilde{\mathbf{C}}}$ according to

$$\hat{\tilde{\mathbf{C}}} = \mathbf{A}\hat{\tilde{\mathbf{K}}}^{\mathrm{T}}(\hat{\tilde{\mathbf{K}}}\hat{\tilde{\mathbf{K}}}^{\mathrm{T}})^{-1} = \mathbf{A}(\hat{\tilde{\mathbf{K}}}^{\mathrm{T}})^{+};$$

h) replacing the augmented portion of the second set of augmented component values $\hat{\tilde{\mathbf{C}}}$ with the at least one vector of the $\mathbf{T}$ scores to obtain a third set of augmented component values $\hat{\tilde{\tilde{\mathbf{C}}}}$ and

i) repeating steps e) through h) at least once, using the augmented component values $\hat{\tilde{\tilde{\mathbf{C}}}}$ in step f).

Claim 76 (original): The method of Claim 75, wherein the steps e) through h) are repeated until the test of step g) converges to obtain an alternating classical least squares solution for $\hat{\tilde{\mathbf{K}}}$ and $\hat{\tilde{\mathbf{C}}}$.

Claim 77 (original): The method of Claim 75, further comprising replacing the augmented portion of the augmented pure-component spectra $\hat{\tilde{\mathbf{K}}}$ with at least one vector of the $\mathbf{P}$ loading vectors prior to step e).

Claim 78 (original): The method of Claim 75, further comprising augmenting $\hat{\tilde{\mathbf{K}}}$ with at least one vector representing a spectral shape that is representative of at least one additional source of spectral variation prior to step e).

Claim 79 (original): The method of Claim 75, further comprising applying at least one constraint to the non-augmented portion of $\hat{\tilde{\mathbf{K}}}$ at step e).

Claim 80 (original): The method of Claim 79, wherein the at least one constraint is selected from the group consisting of non-negativity, equality, closure, monotonic constraint, unimodality, and selectivity.

Claim 81 (original): The method of Claim 75, further comprising applying at least one constraint to the non-augmented portion of $\hat{\tilde{\mathbf{C}}}$ at step g).

Claim 82 (original): The method of Claim 81, wherein the at least one constraint is selected from the group consisting of non-negativity, equality, closure, monotonic constraint, unimodality, and selectivity.

Claim 83 (original): The method of Claim 75, wherein the guessed set of component values $\mathbf{C}$ comprises random numbers.

Claim 84 (original): The method of Claim 75, wherein the measured set of multivariate spectral data $\mathbf{A}$ comprises image data.

Claim 85 (original): The method of Claim 84, wherein the spectral error covariance $\mathbf{E_A}$ is obtained from a shift difference generated from a single image.

Claim 86 (original): The method of Claim 84, wherein the spectral error covariance $\mathbf{E_A}$ is obtained from repeat image spectra.

CONCLUSION

Applicants have canceled the nonelected claims and urge that the application is now in condition for allowance.

Respectfully submitted,

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CERTIFICATION UNDER 37 CFR 1.8

I hereby certify that this correspondence and documents referred to herein were deposited with the United States Postal Service as first class mail addressed to: Commissioner for Patents, Alexandria, VA 22313-1450 on the date shown below.

Date: 7/13/04

By: Martha Trujillo